

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C.20231  
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 29 February 2000 (29.02.00)	
International application No. PCT/NO99/00187	Applicant's or agent's file reference 65238-SS
International filing date (day/month/year) 07 June 1999 (07.06.99)	Priority date (day/month/year) 08 June 1998 (08.06.98)
Applicant JONASSEN, Ola et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
27 December 1999 (27.12.99)

☐ in a notice effecting later election filed with the International Bureau on:  
\_\_\_\_\_

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer F. Baechler Telephone No.: (41-22) 338.83.38
---	---

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

TANDBERGS PATENTKONTOR AS  
Boks 7085  
N-0306 Oslo  
NORVÈGE

Date of mailing (day/month/year) 29 February 2000 (29.02.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 65238-SS	
International application No. PCT/NO99/00187	International filing date (day/month/year) 07 June 1999 (07.06.99)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent <input type="checkbox"/> the common representative
Name and Address LEIV EIRIKSSON NYFOTEK AS Boks 62 Pirsenteret N-7005 Trondheim Norway	State of Nationality NO	State of Residence NO
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input type="checkbox"/> the name	<input checked="" type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence
Name and Address LEIV EIRIKSSON NYFOTEK AS Boks 1262 Pirsenteret N-7462 Trondheim Norway	State of Nationality NO	State of Residence NO
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer F. Baechler
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

1

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 99/00187

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F26B 5/06, B01J 2/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: F26B, B01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5486246 A (KELLEY), 23 January 1996 (23.01.96)	1,2
	--	
A	US 5629191 A (CAHN), 13 May 1997 (13.05.97)	1,2
	--	
	-----	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

### \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

17 Sept 1999

Date of mailing of the international search report

08-10-1999

Name and mailing address of the ISA:

Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Björn Salén/CF

Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

30/08/99

International application No.  
PCT/NO 99/00187

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5486246 A	23/01/96	US 5527498 A	18/06/96
US 5629191 A	13/05/97	NONE	

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 22 MAY 2000

PCT

Applicant's or agent's file reference 65238-SS	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/NO99/00187	International filing date (day/month/year) 07.06.1999	Priority date (day/month/year) 08.06.1998
International Patent Classification (IPC) or national classification and IPC <sub>7</sub> F 26 B 5/06, B 01 J 2/02		
Applicant LEIV EIRIKSSON NYFOTEK AS et al		

<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of _____ sheets.</p>
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>

Date of submission of the demand 27.12.1999	Date of completion of this report 11.05.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Björn Salén/CF Telephone No. 08-782 25 00

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO99/00187

## I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

- ☒ the international application as originally filed.
- ☐ the description, pages \_\_\_\_\_, as originally filed,  
 pages \_\_\_\_\_, filed with the demand,  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_.
- ☐ the claims, Nos. \_\_\_\_\_, as originally filed,  
 Nos. \_\_\_\_\_, as amended under Article 19,  
 Nos. \_\_\_\_\_, filed with the demand,  
 Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_.
- ☐ the drawings, sheets/fig \_\_\_\_\_, as originally filed,  
 sheets/fig \_\_\_\_\_, filed with the demand  
 sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/fig \_\_\_\_\_

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/NO99/00187

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-2</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-2</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-2</u>	YES
	Claims		NO

**2. Citations and explanations**

The present invention relates to a method and an apparatus for producing a porous matrix from a solution, a paste, an extract and a granulated material or such.

Claims 1-2 are not considered to be anticipated by the patent documents US 5 486 246 A and US 5 629 191 cited in the International Search Report. None of these documents reveals a method or an apparatus for drying a medium for producing a porous matrix from a solution, a paste, an extract and a granulated material or such, as described in the claims.

The invention according to claims 1-2 is therefore considered to be novel, to involve an inventive step and to have industrial applicability.

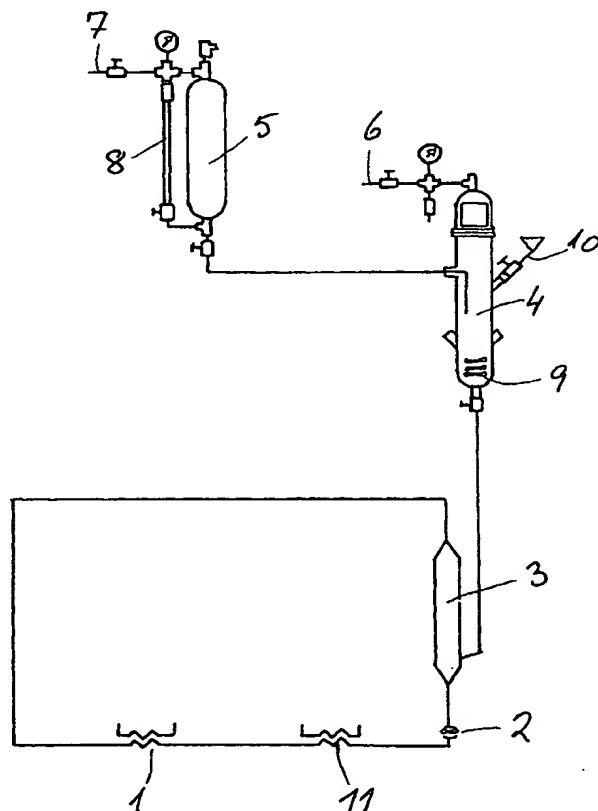


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>F26B 5/06, B01J 2/02</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 99/64802</b> <b>(43) International Publication Date:</b> 16 December 1999 (16.12.99)
<b>(21) International Application Number:</b> PCT/NO99/00187 <b>(22) International Filing Date:</b> 7 June 1999 (07.06.99) <b>(30) Priority Data:</b> 19982626                      8 June 1998 (08.06.98)                      NO <b>(71) Applicant (for all designated States except US):</b> LEIV EIRIKSSON NYFOTEK AS [NO/NO]; Boks 62 Pirsenteret, N-7005 Trondheim (NO). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> JONASSEN, Ola [NO/NO]; Eklesbakken, N-7064 Bratsberg (NO). STRØMMEN, Ingvald [NO/NO]; Væretreå 74, N-7053 Ranheim (NO). SCHIEFLO, Per, Arne [NO/NO]; Osloveien 6, N-7018 Trondheim (NO). ODILIO, Alves-Filho [NO/NO]; Rødrevn. 16F, N-7082 Kattem (NO). <b>(74) Agent:</b> TANDBERGS PATENTKONTOR AS; Boks 7085, N-0306 Oslo (NO).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

**(54) Title:** METHOD AND APPARATUS FOR DRYING A POROUS MATRIX**(57) Abstract**

Method of drying a medium for producing a porous matrix from a solution, a paste, an extract, a granulated material or such, where a liquid inert agent is fed into a vessel (5) at controlled pressure and amount through a valve (7), transferring the pressurized liquid inert agent to a mixing vessel (4), said mixing vessel (4) also receiving the solution, such as paste, extract or granulated material, through an inlet valve (10), adjusting the pressure and temperature inside the mixing vessel (4) to desired levels by a release valve (6), upon complete mixing of the inert agent with the solution, the mixture is expanded into a porous matrix and injected into a drying circuit through a drying chamber (3), the matrix thereby being kept suspended in the drying chamber by the flowing drying medium, supplied by the blower (2), the matrix moisture being removed from the mixture through a heat exchanger coil comprising a first heat exchanger (11) where the water vapour is condensed and removed from the circuit and finally the drying medium is adjusted to the desired inlet condition in a heat exchanger (1) before the drying medium flows through the matrix and the process is repeated.





**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

Method and apparatus for drying a porous matrix

The present invention is related to a method and an apparatus for producing a porous matrix from a solution, a paste, an extract, a granulated material or such, and the drying process.

Developments are continuously made to make processes and apparatus and connectors with freeze drying more economical, more accurate, to a higher degree capturing aromatic and nutritious ingredients during the freeze drying process.

With the method and the apparatus according to present invention, the dryer may operate at different temperature levels and inlet conditions below the freezing point of the material, enabling removal of substantial amount of moisture within a shorter residence time.

With the method according to the present invention is provided a flexibility on the operation since a solution, a suspension, a paste, juices, extract and even finely granulated sticky products can be mixed with an inert agent and expanded as to form a porous matrix. Said porous matrix is progressively dried as it is introduced into the drying chamber, said drying chamber thereby comprising means to adjust the inlet conditions as provided by the heat exchanger and the blower.

By closed loop circulation of the drying air or other media, processing contaminations are avoided and a maximum retention of the final product aroma or odorants as well as other heat sensitive organic components, which would have been lost in open processes.

Uncoupled heat exchangers provide conditioned drying media at appropriate and different levels as to attain minimum thermal inactivation while avoiding degradation of heat sensitive or delicate products. To avoid environmental and thermal pollutions, natural refrigerants are used in the uncoupled heat exchangers.

The above described advantages are achieved with the method and the apparatus according to the present invention as defined with the features stated in the claims.

The drawing discloses in Figure 1 schematically an apparatus according to the invention and Figure 2 discloses

enlarged a control valve used in the apparatus in Figure 1.

According to the invention, an inert agent is introduced into the structural raw material which may be a solution, a paste, an extract, a granulated material or such, whereafter the raw material is expanded to above or below the freezing point of the raw material and to a lower pressure, thereby producing a matrix mainly consisting of solids, pores and ice crystals. The resulting matrix may be frozen prior, or during the drying process or may be directly introduced into drying chamber.

The frozen matrix is placed into the drying chamber of the apparatus whereafter the dryer is activated. The moisture removed from the matrix is guided as an exhaust medium through a heat exchanger having cooled surface coils in which the water vapour condenses and thereafter is removed from the drying circuit.

In the next phase the drying medium is conditioned to the desired and preset inlet condition of the drying chamber by using the heated surface of the heat exchanger. This process is repeated continuously as the drying medium is reentered the drying chamber containing the matrix.

With the apparatus according to the present invention the inert agent is mixed with a matrix in a controlled mixing process. For this purpose the apparatus comprises several components also for conditioning the drying medium.

Reservoir 1 for the inert agent and reservoir 2 for the raw material are preferably made of stainless steel. The outlet of said reservoirs is accurately controlled for fine proposing of the mass fractions, by the use of flow meters and control valves. Pressure and temperature at the reservoir inlets and outlets are recognized by sensors and indicators arranged in the reservoir piping, fittings and connections.

The dryer as such consists of a closed loop in which the drying medium flows after being conditioned in the heat exchanger. The surfaces of the heat exchanger may be independently heated respectively cooled or may as such be connected with the appropriate refiguration systems and heat pumps.

A blower, when activated, provides the flow of the

drying medium through drying chamber containing the fixed or fluidized bed of porous frozen matrix, whereafter the drying as such is accomplished by heat transfer and mass transport mechanisms. The heated and cooled surfaces of the heat exchanger promote dehumidification and conditioning of the drying medium and may be adjusted to provide desired specification and thermal sensitivity of the matrix by specific chamber designs and preset inlet conditions.

With the method and apparatus according to the present invention the dryer is able to operate at different temperature levels and the inlet conditions may be preset at or below the final freezing point of the raw material, such that nearly all of the moisture in the matrix is removed. In connection therewith, the circuit temperature of the heat exchanger may be changed in order to increase the temperature of the drying medium, controlling the relative humidity and consequently attaining a high degree of water removal and a short residence time of the matrix.

The design of the dryer as such enables use of only a fraction of the energy used in conventional processes. Furthermore the closed drying circuit avoids contamination as such, as frequently observed with commercial open systems.

Due to the higher operation temperature and higher operation pressure, the drying process according to the present invention is less expensive than commonly available drying systems having similar capacities. Furthermore the final product from the dryer provides higher and more uniform quality than conventional dryers and spray dryers operating at much higher temperature which furthermore is unsuitable for heat sensitive materials.

The only figure discloses schematically the apparatus arrangement with its vital components. A liquid inert agent is fed into a vessel 5 at controlled pressure and amount through a valve 7. The valve 7 also permits dosing the amount of inert agent inside vessel 5, as inspected through glass level indicator 8.

From the vessel 5 the pressurized liquid inert agent is transferred to the mixing vessel 4 which also receives the solution (paste, extract or granulated material) through an inlet

valve 10. The pressure and temperature inside the mixing vessel 4 is adjusted through the release valve 6. A multi-propeller agitator 9 rotates accordingly to provide a complete mixing of the inert agent with the solution.

5           From the mixing vessel 4, the solution is expanded into a porous matrix and is injected into drying circuit through the drying chamber 3. The matrix is kept suspended in the drying chamber by the flowing drying medium, which is supplied by the blower 2.

10           Besides keeping the porous matrix suspended during the process, the medium re-circulates the drying circuit in a closed loop. After removing the matrix moisture the exhaust medium is moved through a heat exchanger coil comprising a first heat exchanger 11 where the water vapour is condensed and removed from  
15 the circuit. Thereafter the drying medium is adjusted to the desired inlet condition in the heat exchanger 1. Finally the drying medium flows through the matrix and the process is repeated.

20

25

30

35

P a t e n t   C l a i m s

5            1. Method of drying a medium for producing a porous matrix from a solution, a paste, an extract, a granulated material or such, **CHARACTERIZED IN** feeding a liquid inert agent into a vessel (5) at controlled pressure and amount through a valve (7), transferring the pressurized liquid inert agent to a  
10 mixing vessel (4), said mixing vessel (4) also receiving the solution, such as paste, extract or granulated material, through an inlet valve (10), adjusting the pressure and temperature inside the mixing vessel (4) to desired levels by a release valve (6), upon complete mixing of the inert agent with the solution,  
15 the mixture is expanded into a porous matrix and injected into a drying circuit through a drying chamber (3), the matrix thereby being kept suspended in the drying chamber by the flowing drying medium, supplied by the blower 2, the matrix moisture being removed from the mixture through a heat exchanger coil comprising  
20 a first heat exchanger (11) where the water vapour is condensed and removed from the circuit and finally the drying medium is adjusted to the desired inlet condition in a heat exchanger (1) before the drying medium flows through the matrix and the process is repeated.

25            2. Apparatus adapted for drying a medium for producing a porous matrix from a solution, a paste, an extract, a granulated material or such, **CHARACTERIZED IN** the apparatus comprising a valve (7) being connected with a vessel (5) for feeding a liquified inert agent into the vessel (5) at controlled  
30 pressure and rate, the valve (7) thereby allowing dosing of the agent, a mixing vessel (4) being connected with the vessel (5) adapted to receive pressurized liquid inert agent as well as a solution such as a paste, an extract or a granulated material, through an inlet valve (10), a release valve (6) thereby  
35 controlling the pressure and the temperature inside the mixing vessel (4), an agitator (9) inside the mixing vessel (4) thereby ensuring complete mixing of the agent with the solution, a drying chamber (3) being connected with the mixing vessel (4) to receive the mixture as a porous matrix which thereby is injected into a

drying circuit through the drying chamber (3), and a first heat exchanger (10) being connected with the circuit for condensing and removing the water vapour from the circuit, the drying medium thereafter being adjusted to the inlet condition of the drying chamber (3) by a second heat exchanger (1).

10

15

20

25

30

35

1/1

